

Advances in Fire Danger Rating Using Precipitation Estimates from Space

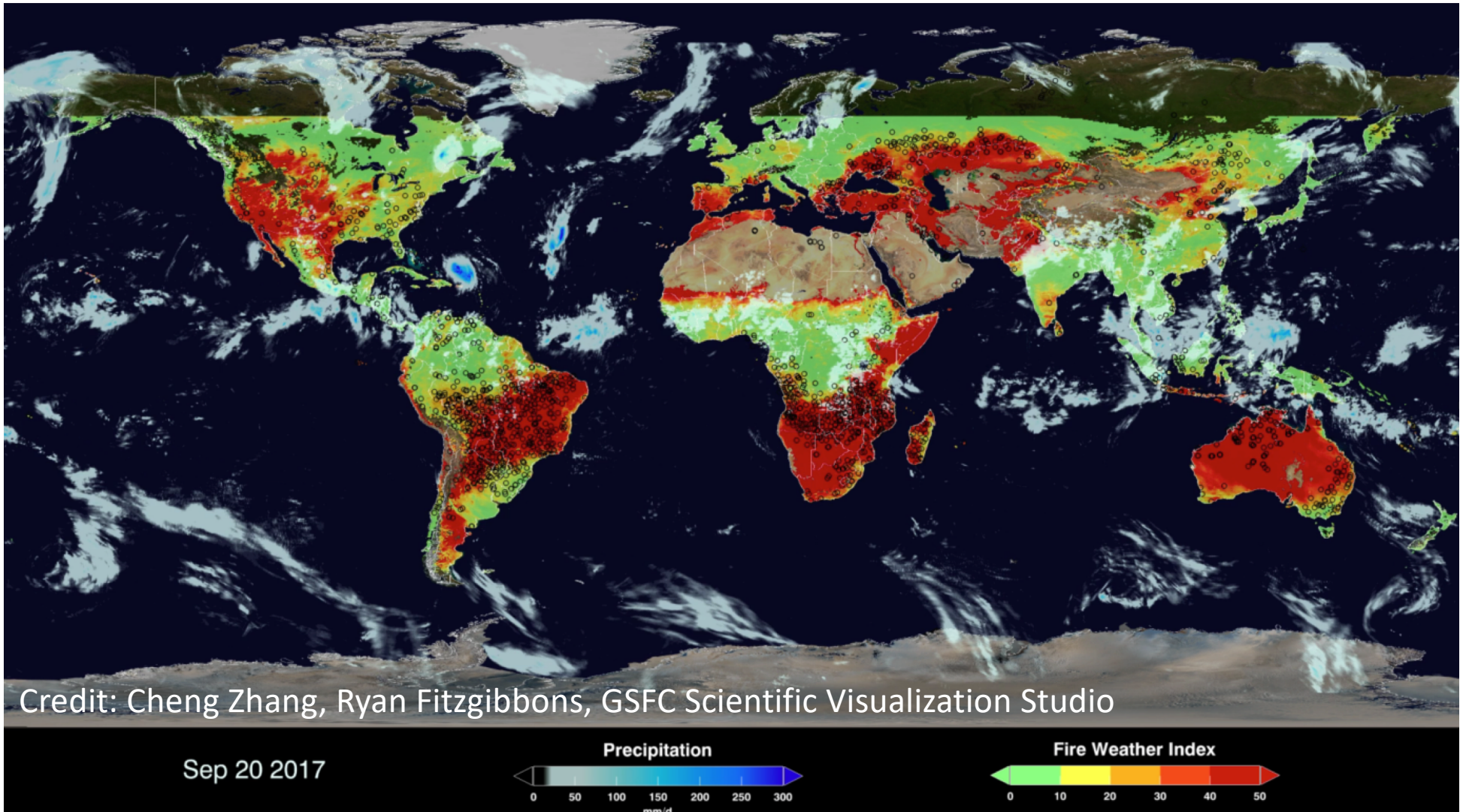
Robert Field

 COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

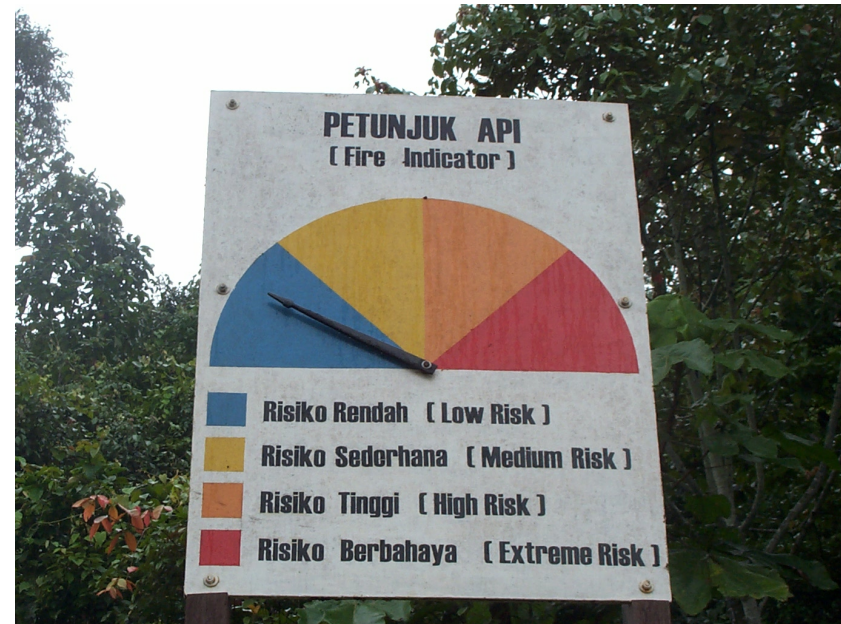
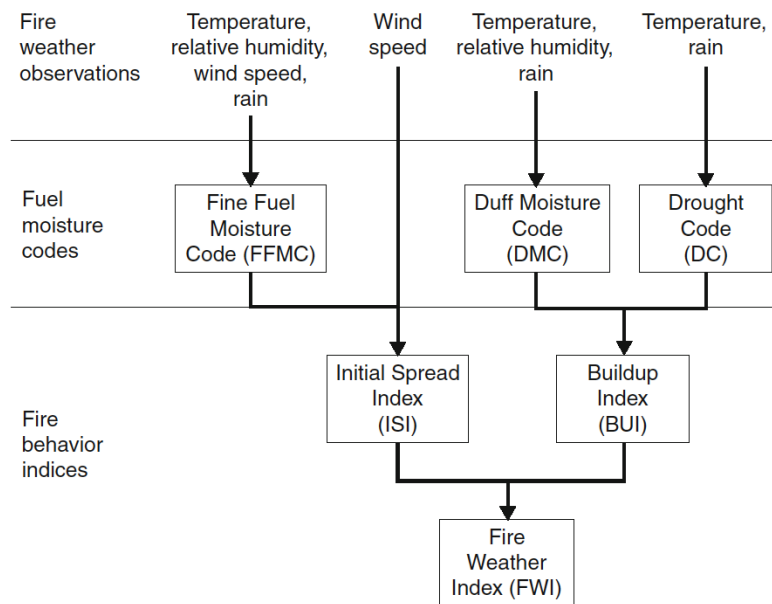
 National Aeronautics and Space Administration
Goddard Institute for Space Studies
New York, N.Y.



 GROUP ON
EARTH OBSERVATIONS



The Fire Weather Index (FWI) System is the most commonly used fire danger rating system in the world.



de Groot, W. J., and M. D. Flannigan (2014), Climate Change and Early Warning Systems for Wildland Fire, in Reducing Disaster: Early Warning Systems for Climate Change, edited by Z. Zommers and A. Singh, pp. 127-151, Springer, Dordrecht, doi:10.1007/978-94-017-8598-3.

Global Fire Weather Database

National Aeronautics and Space Administration
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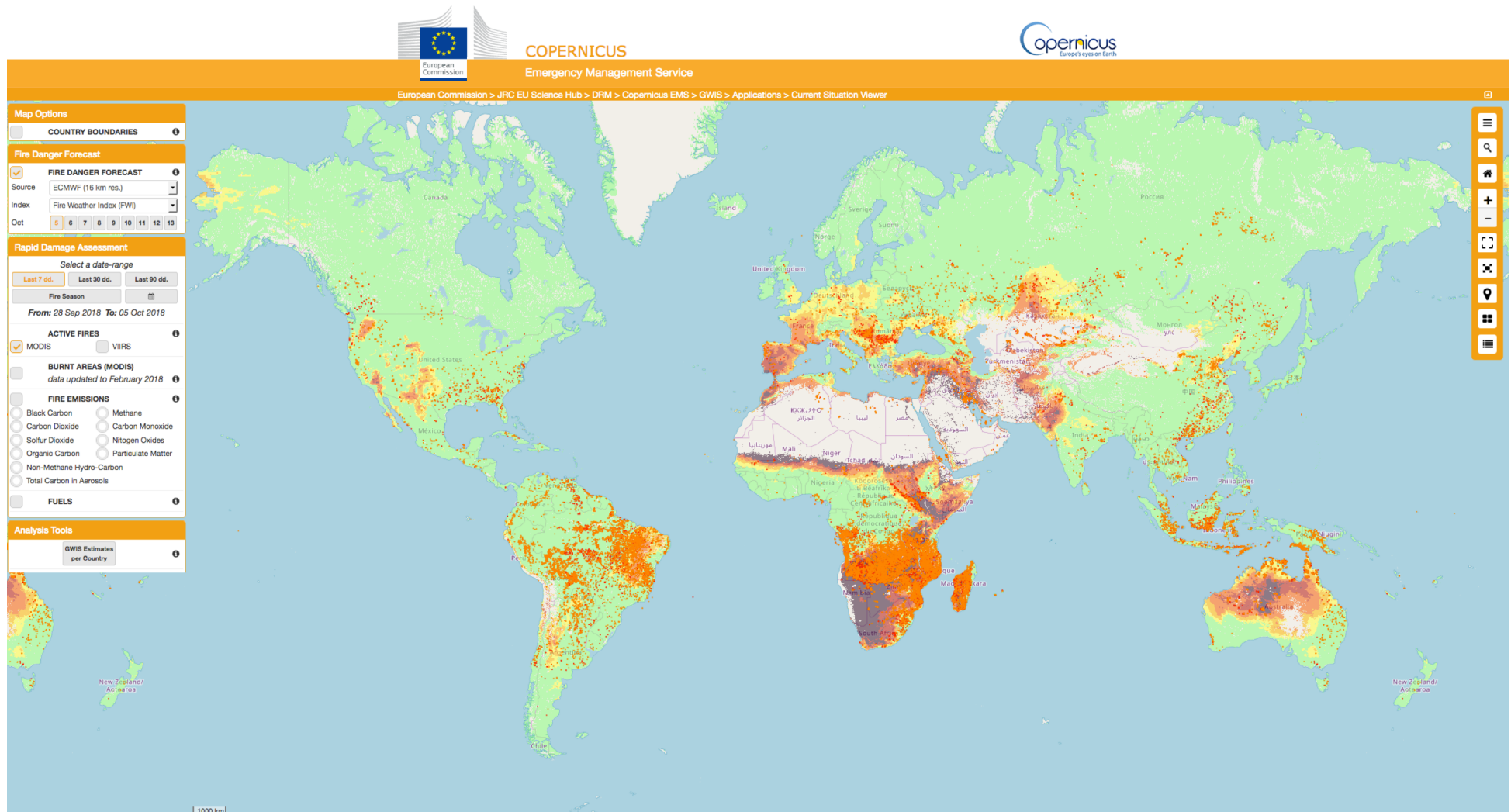
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Global Fire WEather Database (GFWED)

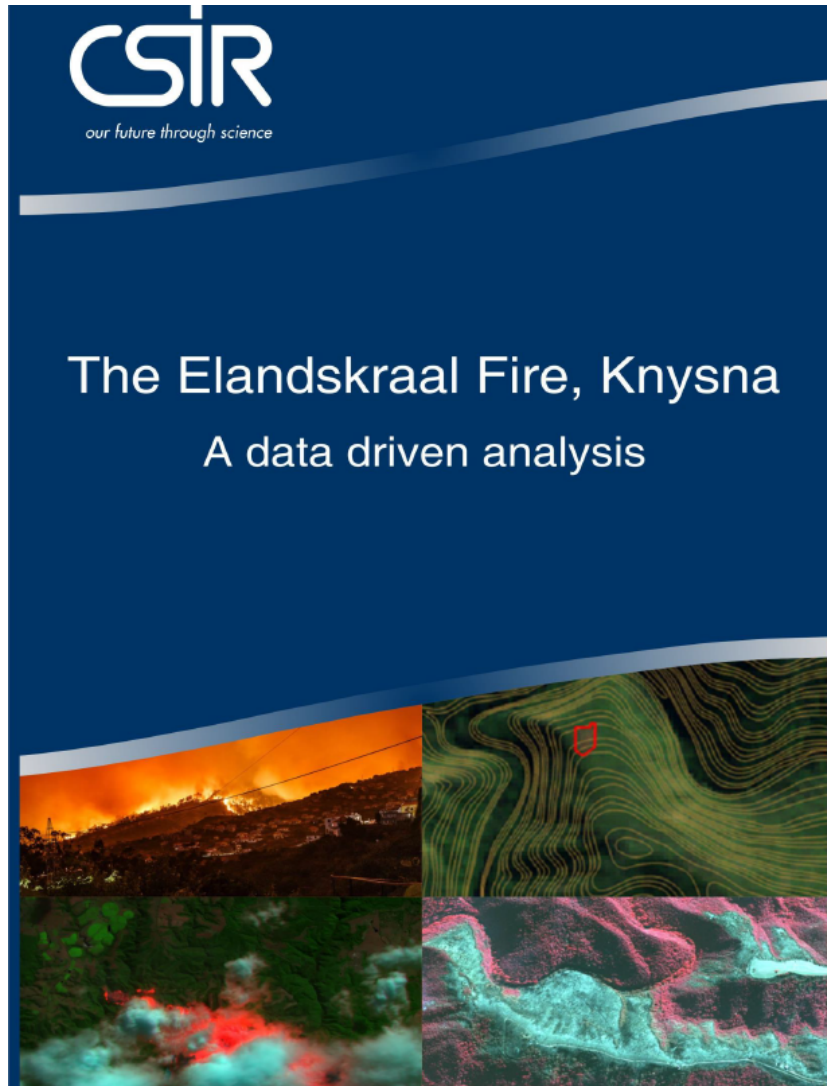
	Data source	Period	Latency	Coverage	Resolution	Description
T, RH, wind-speed, snow depth	MERRA-2	1981-Present	~2 months	Global	0.5°×2/3°	All versions of the FWI calculations use the MERRA-2 T, RH, wind speed and snow depth estimates
	GEOS-5	2014-present (analysis) December 2017-present (forecasts)	~12 hrs	Global	0.25°×0.25°	NRT 7-day forecasts, analysis versions using GEOS-5, IMERG and CPC precipitation
Precipitation	MERRA-2 raw precipitation (PRECTOT)	1981-Present	~2 months	Global	0.5°×2/3°	Precip estimate from model w/ assimilation
	MERRA-2 bias-corrected precipitation (PRECTOTCORR)	1981-Present	~2 months	Global	0.5°×2/3°	Gauge-corrected precipitation used by aerosol wet removal and land surface schemes
	Sheffield / Princeton precipitation	1981-2010	variable, 4+years	Global	0.5°×0.5°	CRU-corrected NCEP I
	NCEP CPC gauge-based analysis of global precipitation	1981-Present	1 day	Global	0.5°×0.5°	Primarily gauges from WMO-level synoptic network
	GPCP 1-degree-daily v1.2	1997-Present	6+ months	Global	1.0°×1.0°	With IR, microwave and gauges. V1.3 forthcoming
	TRMM 3B42	1998-2014	N/A	50S-50N	0.25°×0.25°	After 2014, this is 'pseudo-TRMM', i.e. same retrieval but without TRMM instruments
	GPM IMERG - Final (GPM_3IMERGDF.03)	20140401-Present	5+ mo.	60S-60N	0.1°×0.1°	Final version with maximum data assimilation and correction incl. rain gauges
	GPM IMERG - Early (GPM_3IMERGDL.03)	20150401-Present	1 day	60S-60N	0.1°×0.1°	Early, NRT version but with less assimilation and correction

<https://data.giss.nasa.gov/impacts/gfwed/>

GFWED data will soon be available through the Global Wildfire Information System.

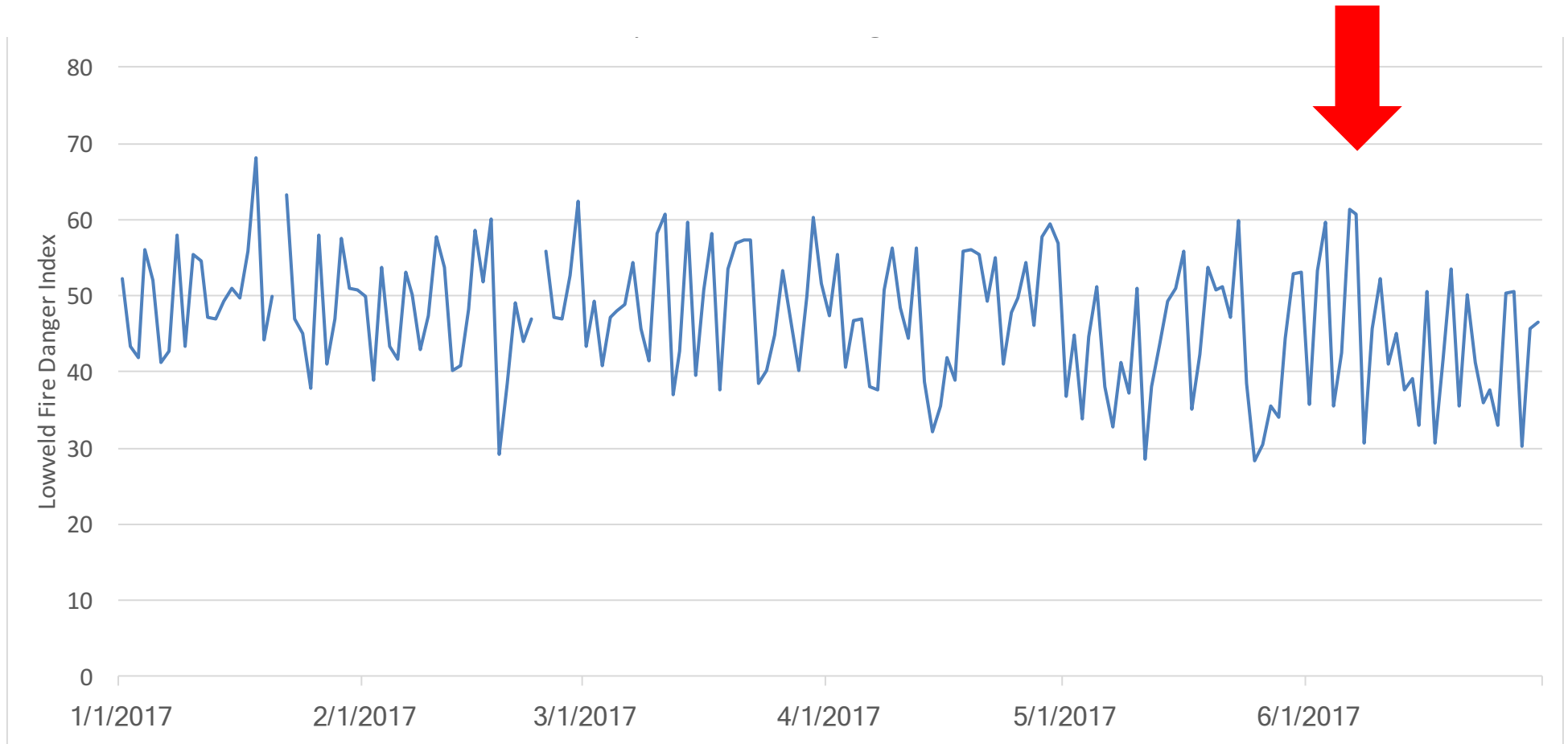


Recent application: South Africa



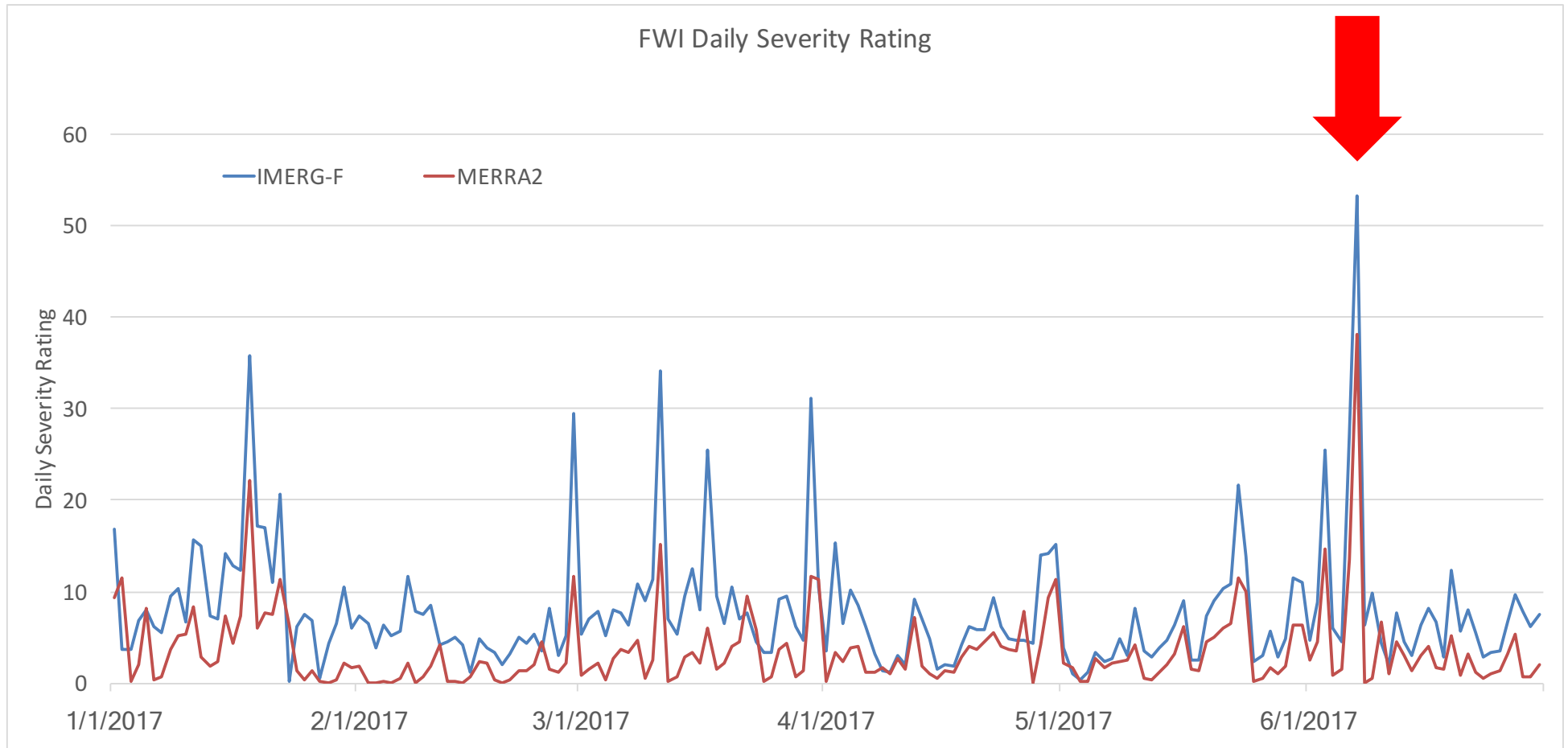
c/o: Philip Frost
Council for Scientific and Industrial Research

Lowveld Fire Danger Index, 2017



c/o: Philip Frost
Council for Scientific and Industrial Research

FWI System Daily Severity Rating



c/o: Philip Frost
Council for Scientific and Industrial Research

July 23rd, 2018 Attica fires near Athens

The New York Times

*In Greece, Wildfires Kill Dozens,
Driving Some Into the Sea*

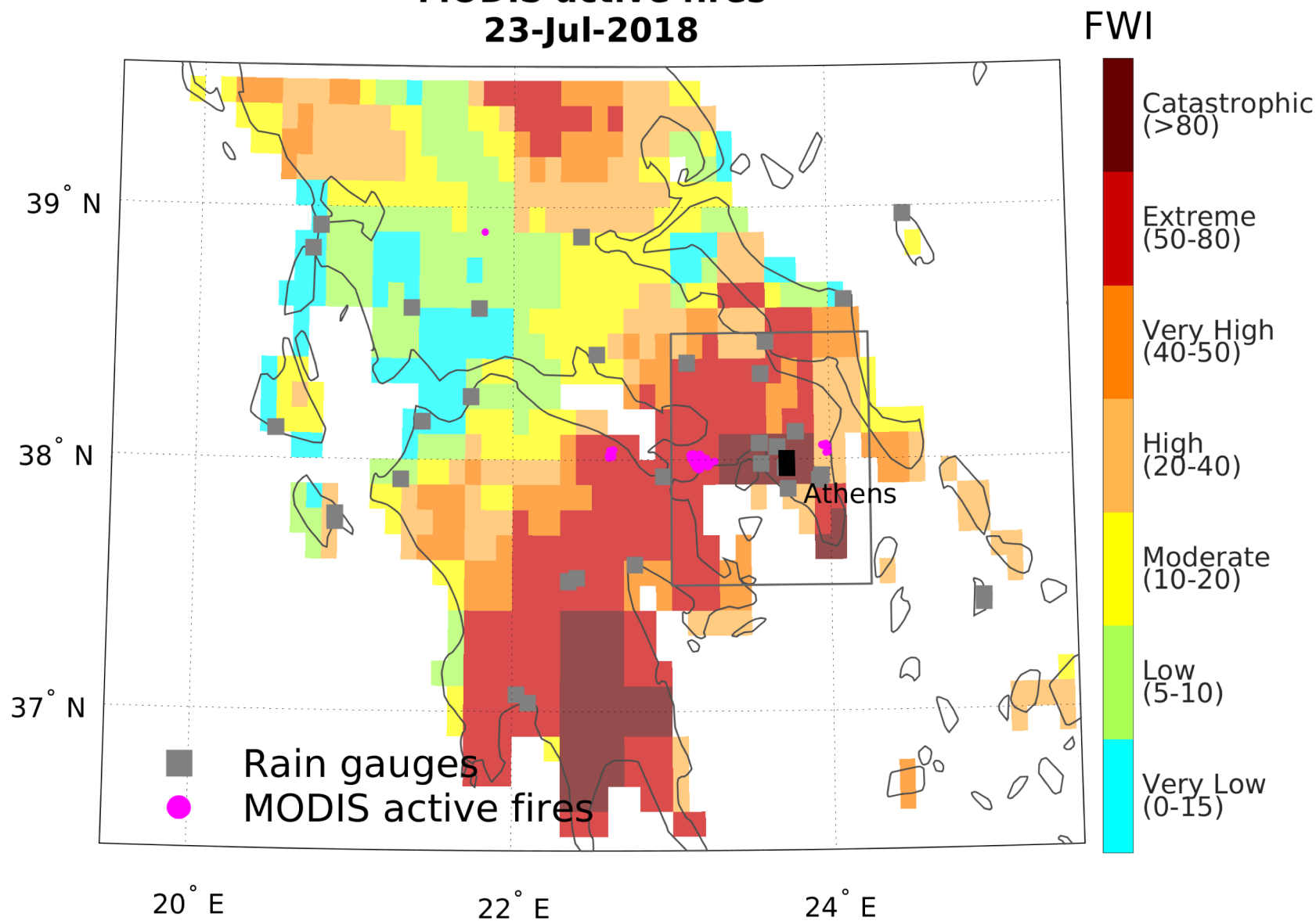


Greece wildfires

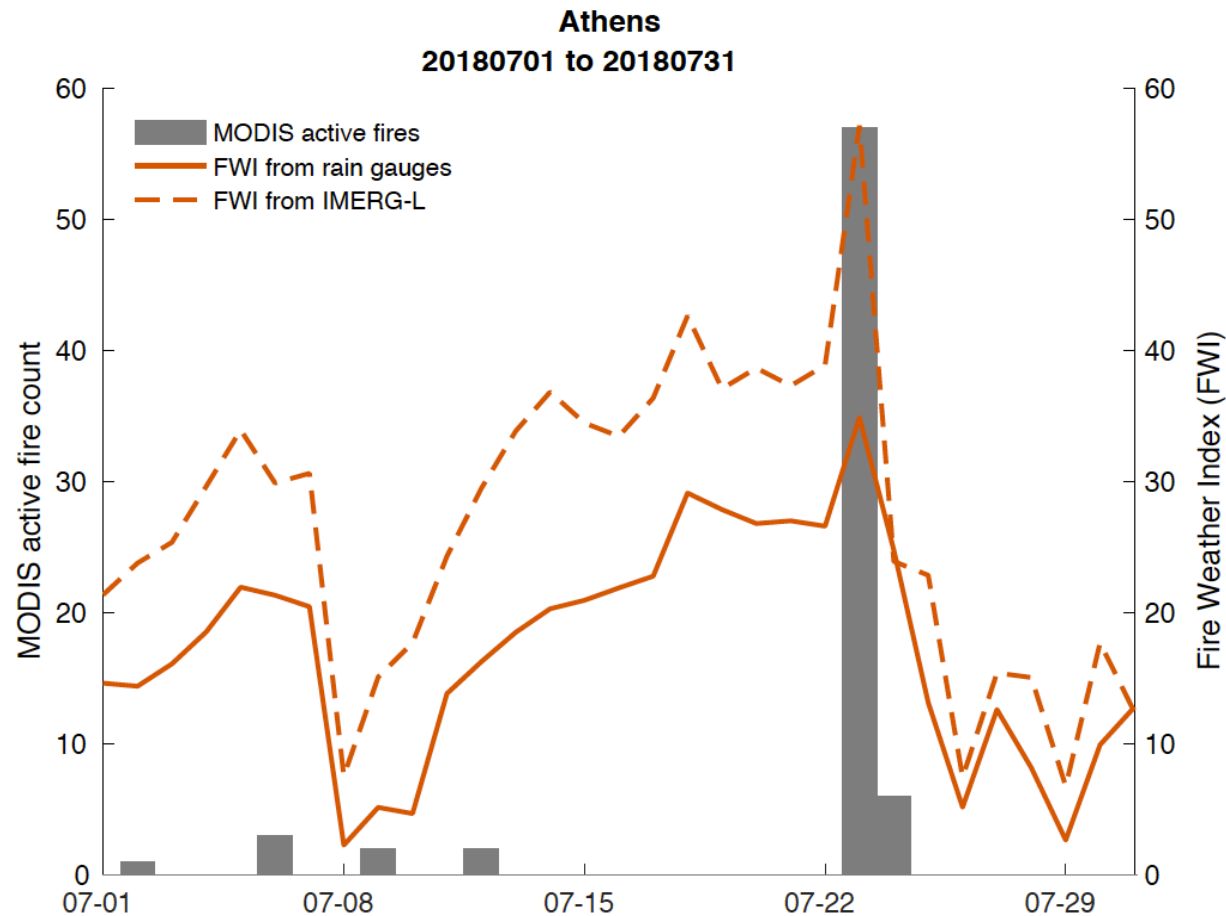


Orange represents fires detected by satellites on July 24. Sources: NASA Earthdata/FIRMS, maps4news/here

**Fire Weather Index (FWI) from IMERG-L
MODIS active fires
23-Jul-2018**



Sensitivity to differences in antecedent precipitation



Differences in FWI on July 23rd due to different rainfall estimates 2 weeks prior.

July 8-10

26mm total from gauges

9 mm from IMERG

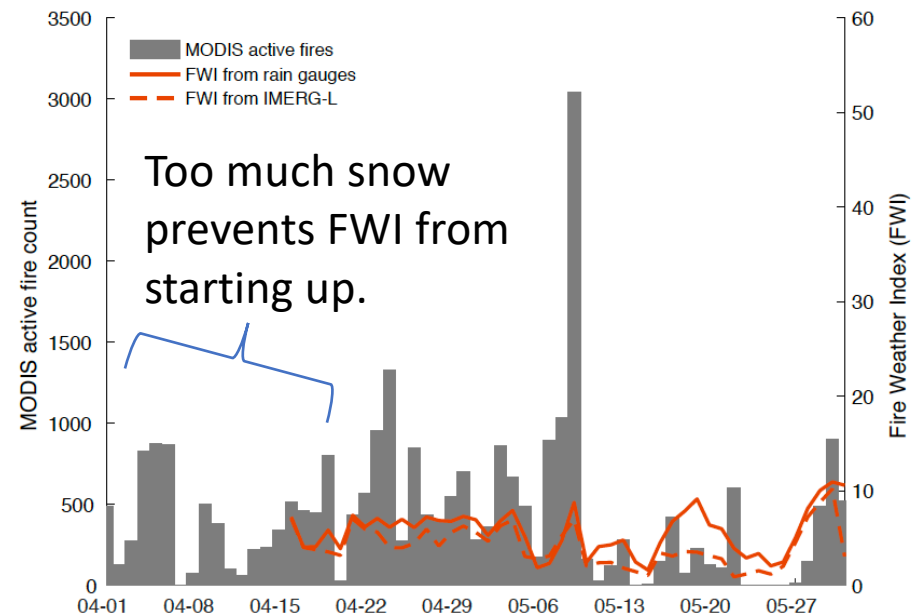
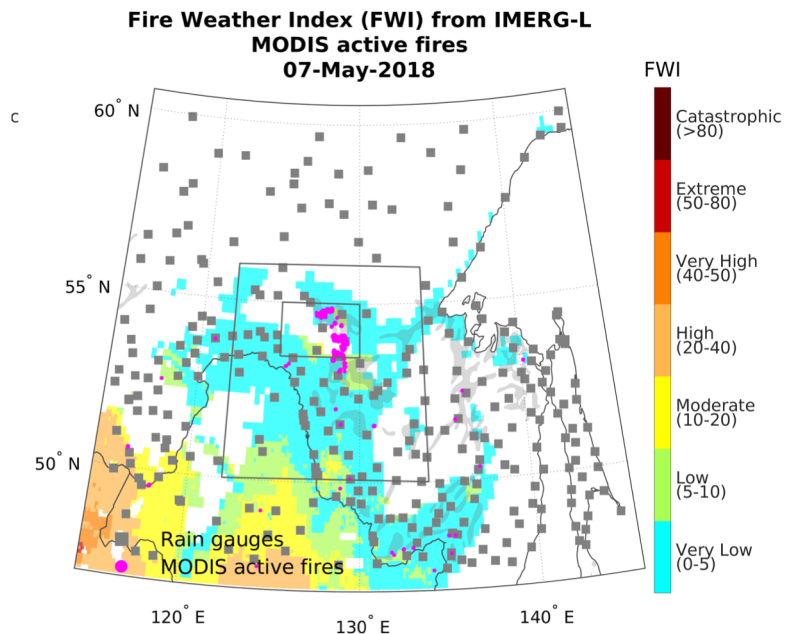
April 2018 Amur Oblast fires in Siberia show that startup procedures need work.



earth
observatory



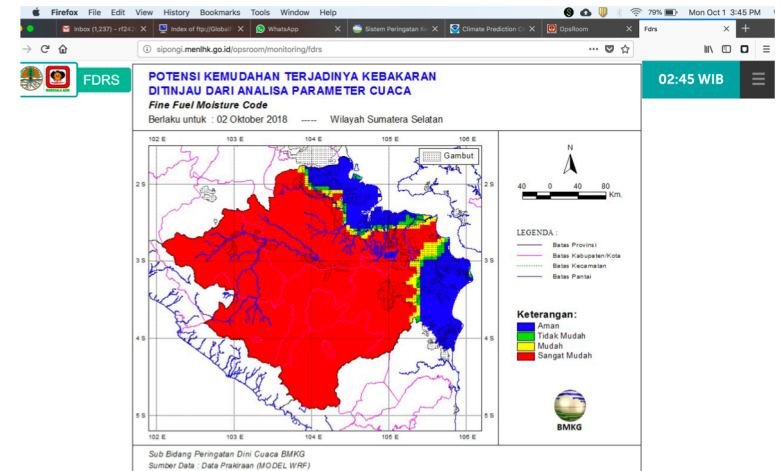
Sweltering, Smoky Fires in Siberia



GFWED Priorities

- Improved overwintering procedures, perhaps making use of alternative snow-cover and soil-moisture estimates, land surface models.
- Evaluation against FWI calculations from hourly, high-quality, non-assimilated, “out-of-sample” weather station data.
- Incorporate vegetation
 - Fire danger indices with physical units for better fire behavior characterization and impact studies (ecological effects, emissions)
 - US National Fire Danger Rating System numbers for more US applications.
- Development of modular training and interpretive material.

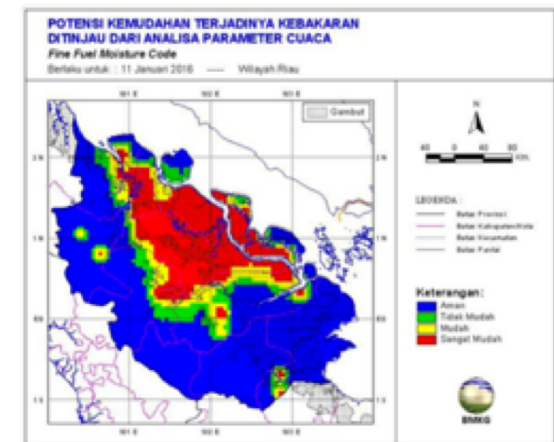
Improvements to Indonesian Fire Danger Rating System



Sutopo Purwo Nugroho @Sutopo_BNPB
Following

Awas Riau mulai berpotensi karhutla lagi. Lahan mulai kering dan sangat mudah terbakar 11-1-2016.

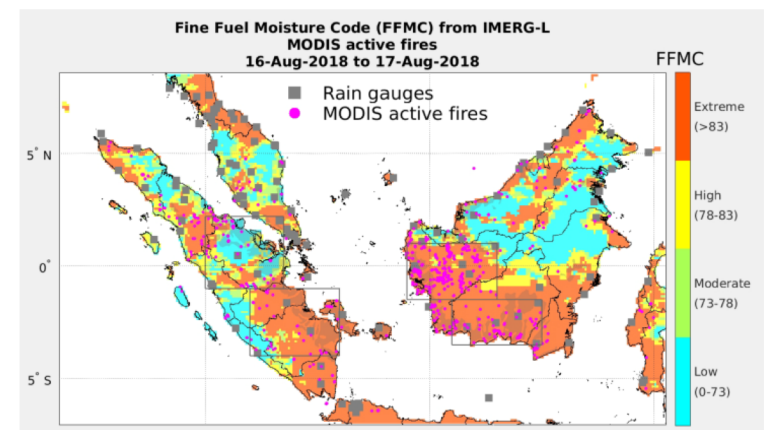
Translate from Indonesian



Fuel Fuel Moisture Code (FFMC)

The Fine Fuel Moisture Code (FFMC) is used in Indonesia as an indicator of the potential for fires to start in light surface fuels (*de Groot et al., 2007*).

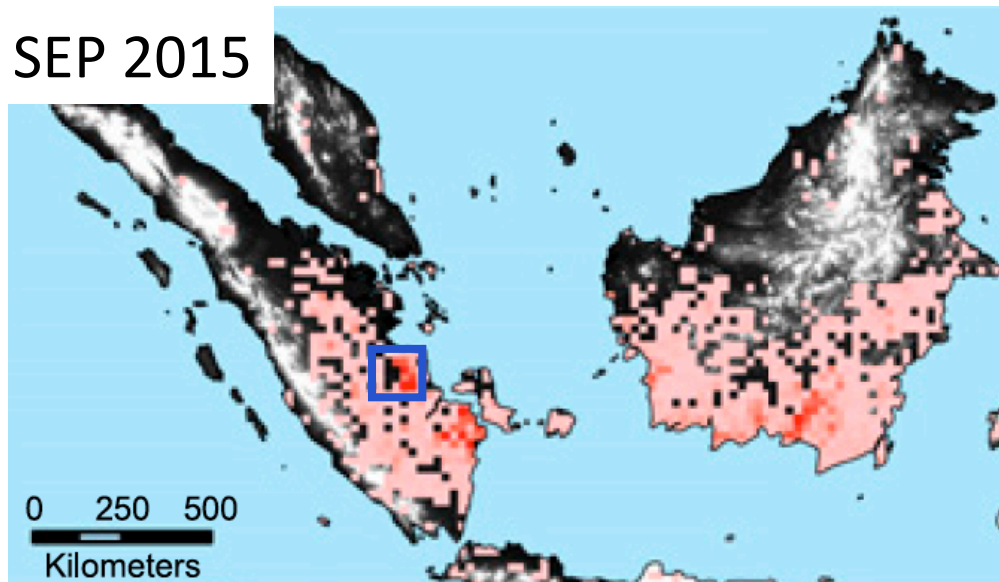
The FFMC ranges from 0-100, with **values greater than 83 considered extreme.**



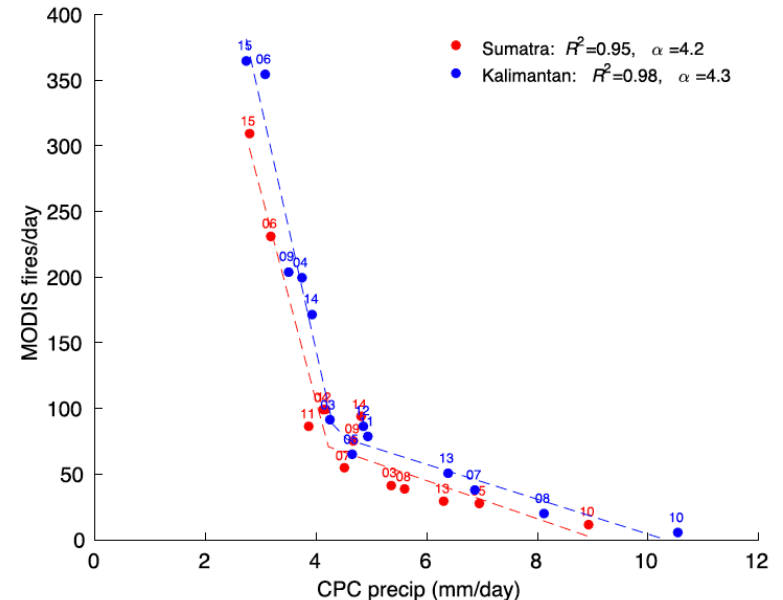
How do different FFMC estimates perform over serious burning regions?

MODIS active fire density (Field et al., 2016, PNAS)

SEP 2015



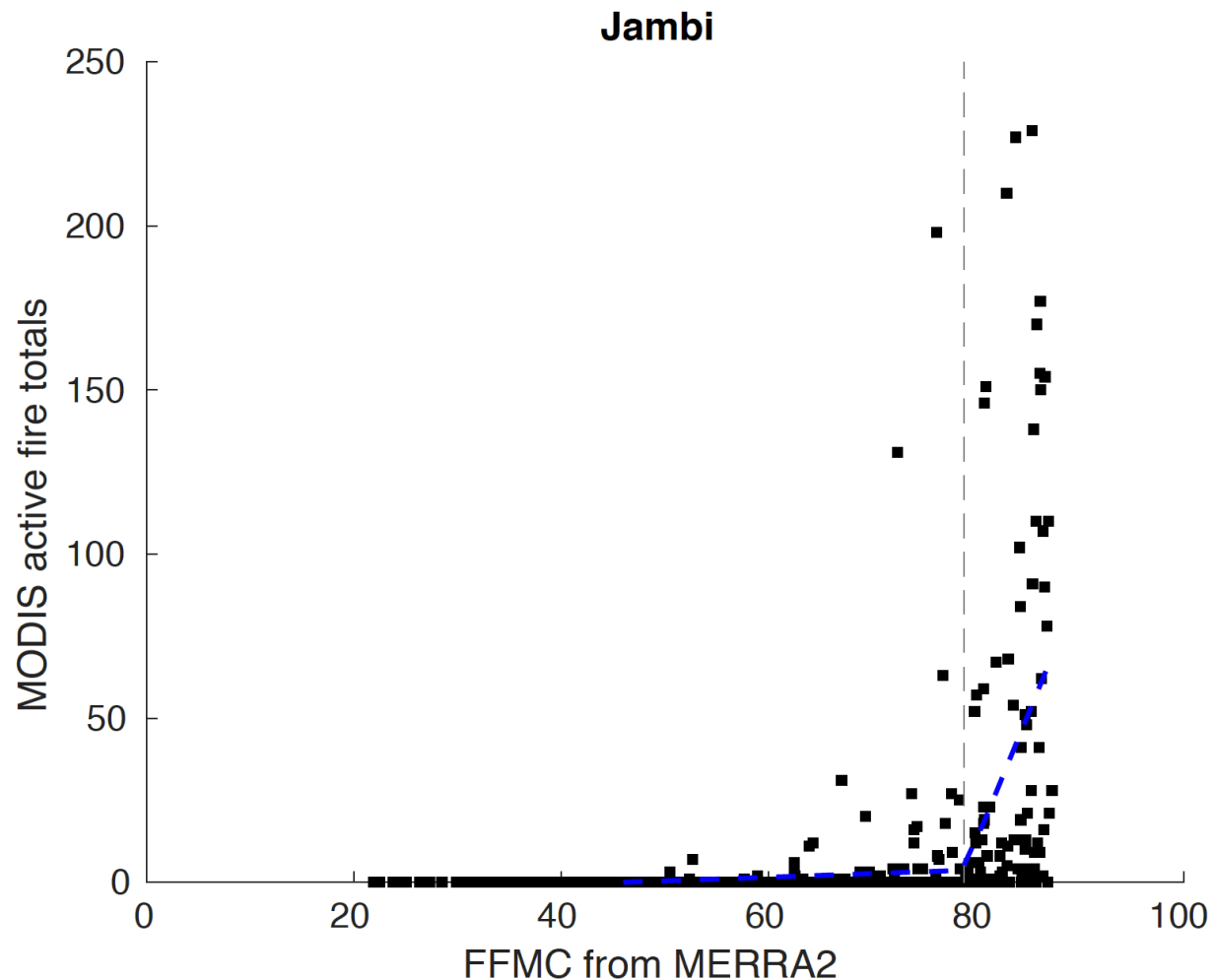
Strong non-linear precipitation influence on fire activity



Field et al. (2006, PNAS)

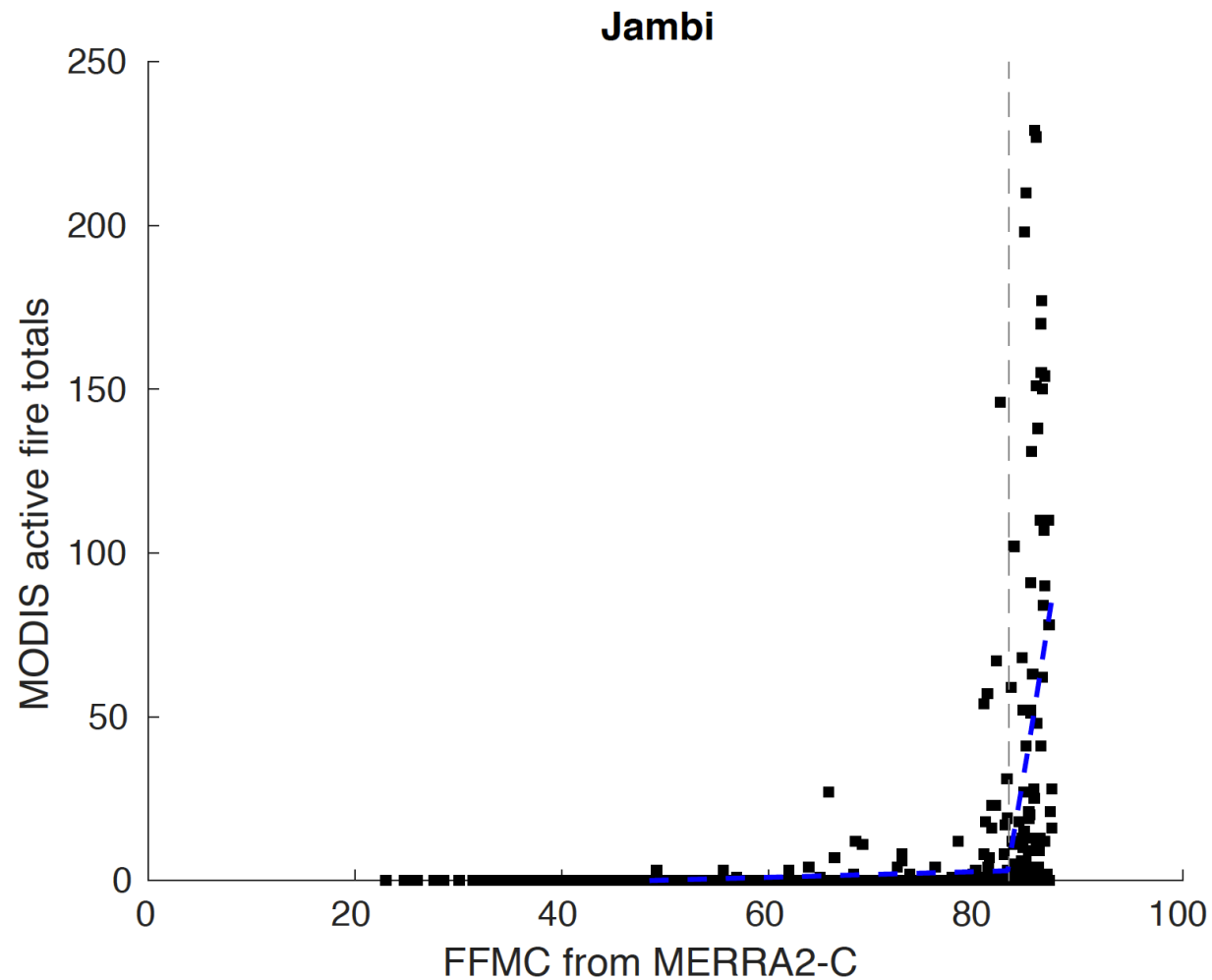
Daily MERRA2 FFMC vs. MODIS active fires, 2015-2018

Reanalysis FFMC generally separates fire from no fire,
but with a lot of below-threshold outliers.



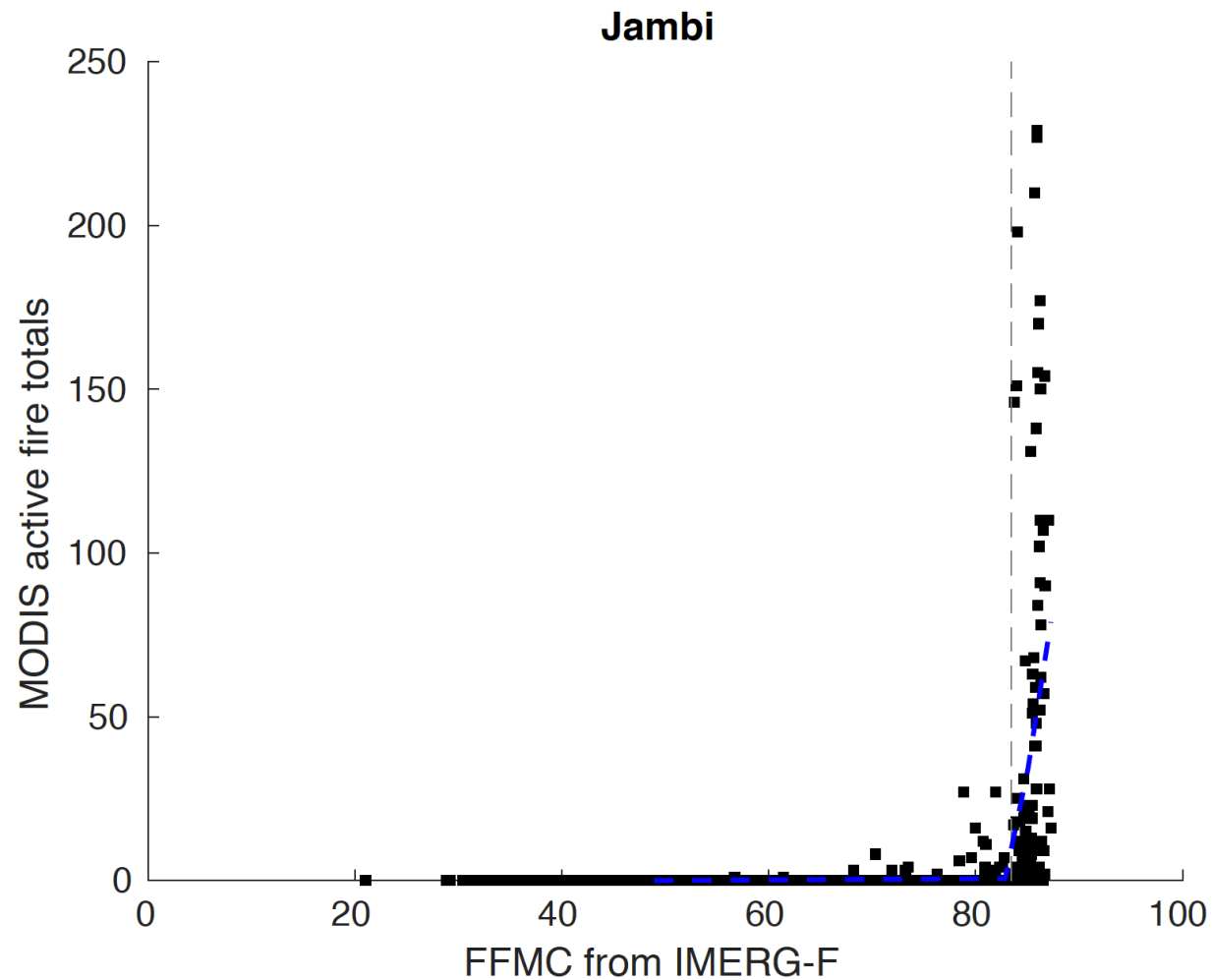
Daily gauge FFMC vs. MODIS active fires, 2015-2018

Better with rain gauges

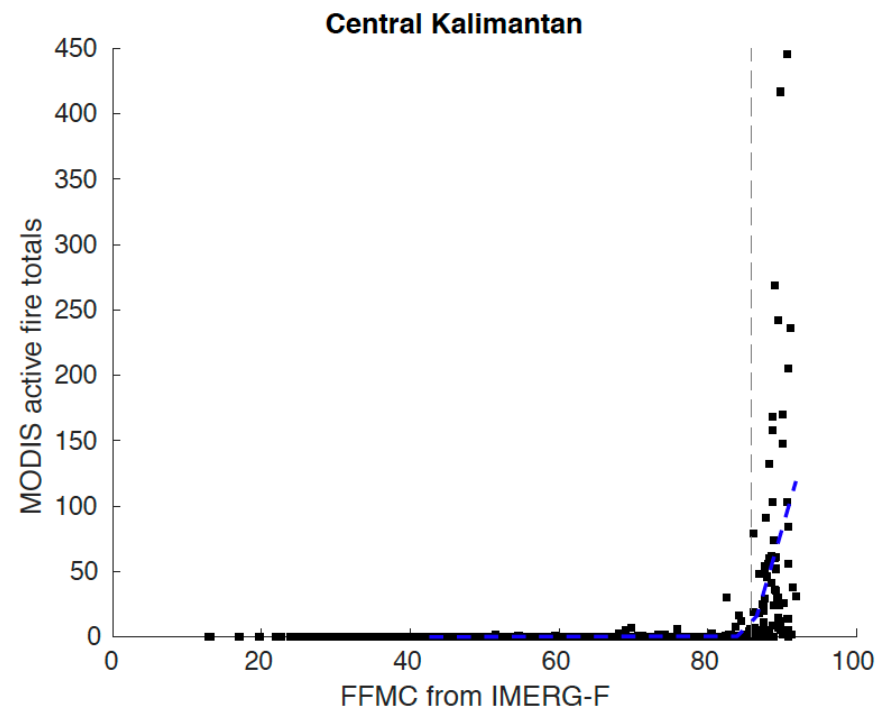
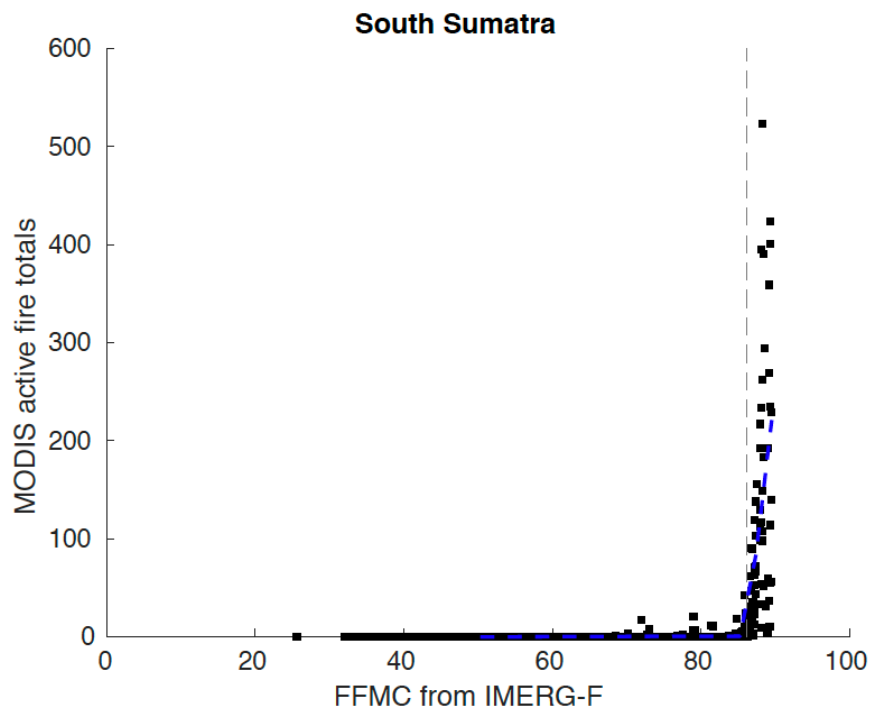


Daily IMERG-F FFMC vs. MODIS active fires, 2015-2018

Best with rain gauges and satellites



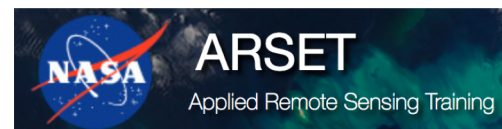
FFMC from IMERG-F works also well over South Sumatra and Central Kalimantan



Indonesian Fire Danger Rating System: Training Program and Technical Enhancements

July 16th-July 20th, 2018

BMKG Headquarters, Jakarta, Indonesia

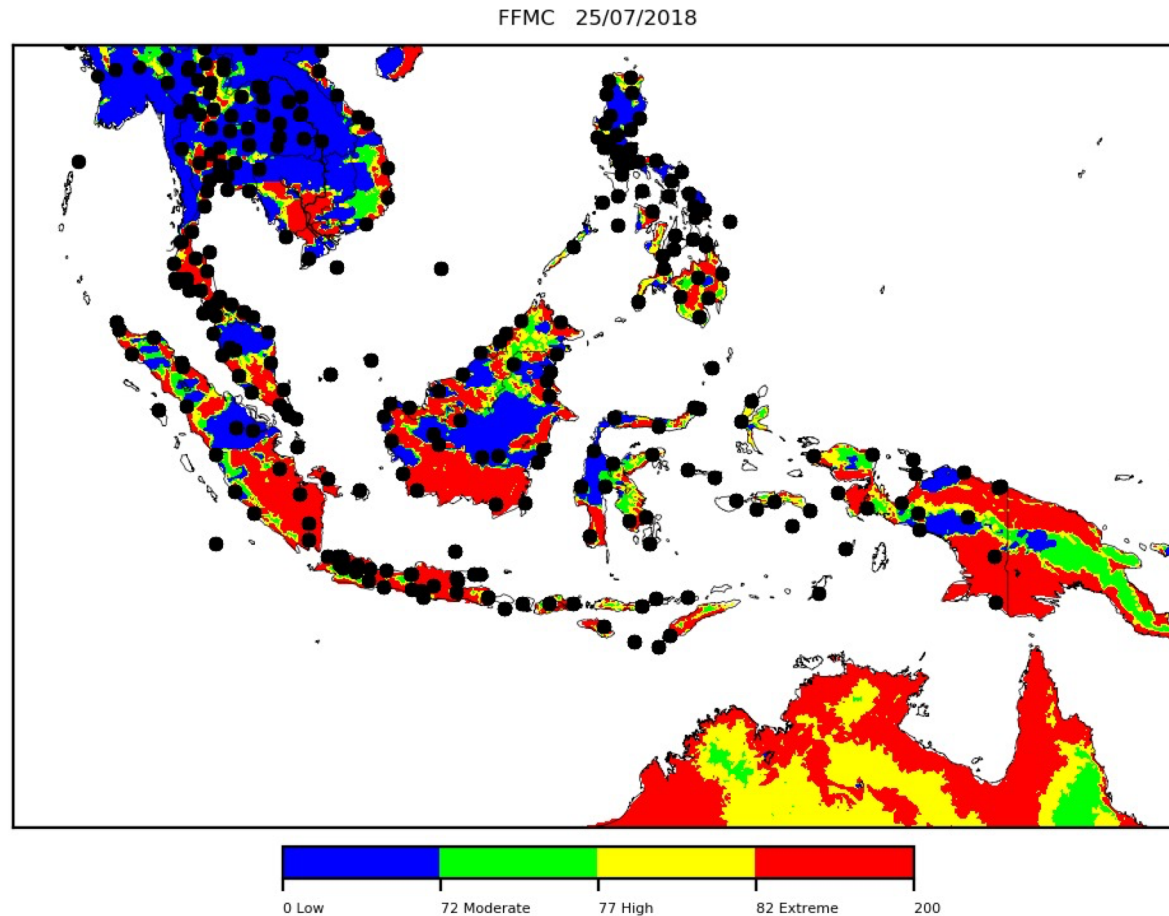


Outcomes

- Adopt standard calibration of FPMC, ISI and DC as a starting point for inter-agency interpretation.
- Review performance of KLHK weather data instruments.
- Develop in-house BMKG FDRS software using GPM-based precipitation estimates, in coordination with planned improvements to LAPAN's FDRS.
- Propose development of basic and advanced FDRS training programs to BMKG Center for Training and Education, using WMO guidelines, in both English and Bahasa Indonesia.

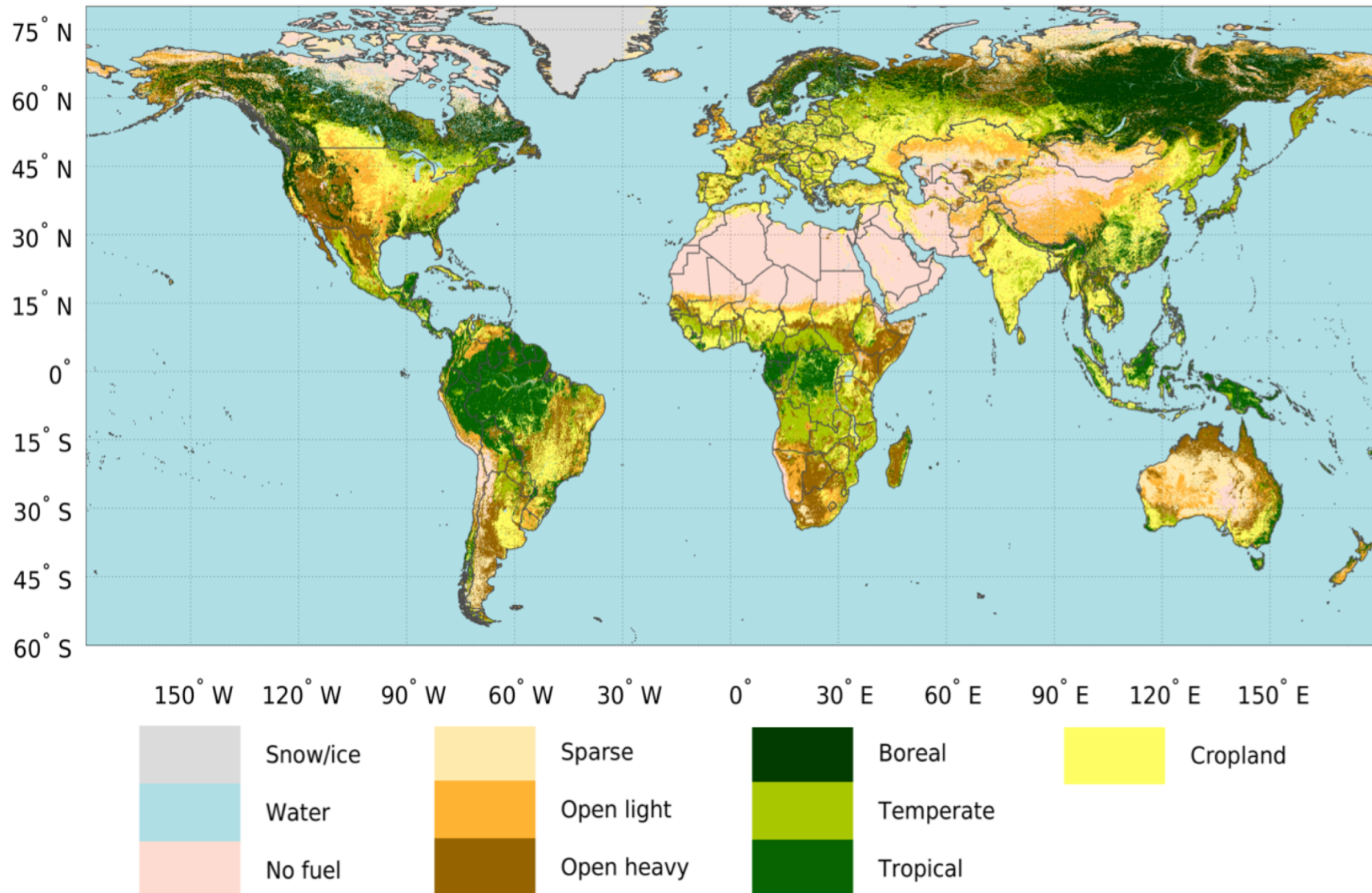
Update from BMKG

Recent progress calculating FWI from JAXA's GSMPaP, writing in-house software.



c/o Andersen Panjaitan, BMKG

Preliminary mapping of UN LCCS types to fuel models



	Rationale
BMKG	BMKG is the official provider of national FDRS information.
KLHK	KLHK is central to fire management in Indonesia. There was a specific training need identified for district leaders, who have to communicate FDRS information to community members.
BNPB (national), BPBD (provincial)	The Indonesian National Board for Disaster Management (BNPB) assumes fire management coordination role during disaster-level conditions.
LAPAN	LAPAN is the official provider of satellite-based fire information (e.g. hotspots).
BRG	Badan Restorasi Gambut (BRG) is the focal point of efforts to rehabilitate/re-wet peatlands.
Ministry of Health	The Ministry of Health is central to haze mitigation and air quality impact monitoring.
Police, Military	The police and military play important roles in fire suppression and enforcement.
BAPPENAS	The Indonesian Ministry of National Development Planning is the focal point for Indonesia's Grand Design for Forest Fires.

	Rationale
Ministry of Agriculture	The Ministry of Agriculture has its own weather station network.
Coordinating Minister of Economy	The Ministry has launched a program clustering villages for forest fire management responsibility.
BPPT	BPPT has been involved in FDRS development, including ongoing work into 'Advanced FDRS'. BPPT plays an important technology transfer and training role, for example with private sector partners.
NGOs	NGOs play an important role in fire prevention and mitigation, and in research into the socio-economic drivers, alternatives to burning.
Universities	University researchers play an important role in basic fire science and impacts research.
Private sector	Larger private sector actors maintain their own fire management programs.
ASEAN	ASEAN is the focal point for regional haze monitoring and mitigation policy efforts.
Media	Need to be able to accurately report on FDRS numbers and their meaning.